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**Frequency of Medical Complications in Patients with Sub Arachnoid Hemorrhage  
(Case Study: Imam Khomeini Hospital of Urumia City)**

**Title:**

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## **ABSTRACT**

### **background and aim of study:**

Subarachnoid hemorrhage usually occurs as a result of ruptured brain aneurysm or an arterial venous malformation. As, these patients are often admitted to the ICU because of the critical condition and secondary complications management is one of the challenging therapeutic issues of these patients during ICU admission, in this study, the frequency of complications of patients with SAH was investigated, who were admitted in ICU of Imam Khomeini Hospital of Urumia within a 7-year period.

### **Methods and materials:**

In this study, the information and clinical complications of the disease (anemia, fever, hyperglycemia, hypertension, electrolyte imbalance, and cardiac arrhythmia) were extracted out of the medical records of the patients with SAH admitted in ICU. Finally, the recorded data were analyzed using SPSS 21 software.

### **Results:**

The statistical population is the patients of Imam Khomeini Hospital in Urmia and the statistical sample number is 483 patients with SAH. 183 (37.9%) out of total samples had anemia, 174 individuals (36%) were suffering from fever, 204 patients (42.2%) were indulged with hypertension. 111 patients (23%) had hyperglycemia, 54 individuals (11.2%) were suffering from sodium disorder. Also, 131 individuals (27.1%) had cardiac arrhythmias.

### **Discussion:**

The results show that the most common complications after SAH are hypertension, anemia and fever. Furthermore, there was a significant correlation between cardiac arrhythmias and sodium and hyperglycemia disorders with the outcome of patients.

**Key words:** Cerebrovascular Disorders, Subarachnoid hemorrhage, Intensive Care Units

### **1-Introduction**

Subarachnoid hemorrhage usually occurs as a result of ruptured brain aneurysm or an arterial venous malformation spontaneously. The onset of symptoms is sudden in SAH and has always been accompanied by a headache that is severe typically but not irreversible. Often at the onset, consciousness is lost transiently or permanently, and in this case, decerebrates posturing or rarely seizure is likely to occur. About 5% of autopsied people had brain aneurysms that have never experienced rupture symptoms. Still, HTN has not been identified as the underlying cause of aneurysm formation definitely. However, acute blood pressure can be responsible for ruptured brain aneurysms. Fusiform aneurysms are the result of peripheral expansion of the body of a brain artery. Contrary to saccular aneurysms, it is thought that these aneurysms are caused by atherosclerosis or dissection. The main complications of aneurysm rupture include death, recurrent intracerebral hemorrhage and vasospasm, seizure (10%), acute and chronic hydrocephalus, and intracranial hematoma [1]. Complications following SAH may occur,

including hyperglycemia, hypo and hypernatremia, fever and pneumonia, hypotension, hypertension, pulmonary edema, and heart arrhythmia [3]. Frontera JA et al. (2006) examined hyperglycemia after SAH and predicted subsequent complications and its effect on outcome. GB average was defined as the average maximum daily blood glucose level of 5.8 mmol / L (105 mg / dl). The results indicate that the measured GB average was 1.8 mmol / L (33 mg / dl). The hyperglycemia after SAH was associated with serious hospital complications and increased hospitalization time in ICU and increased risk of death or serious disability [4]. DorhoutMeesSM et al. (2008) conducted a study on fever after aneurismal SAH and its association with the development of hydrocephaly and bleeding. The results revealed that intraventricular blood volume was an independent risk factor for fever. In this study, non-infectious fever was rare and unrelated to blood extracted from the veins and hydrocephaly [5]. KE et al. (2006) examined the medical complications after subarachnoid hemorrhage and a new strategy for its prevention and management. The results showed that fever, anemia, hyperglycemia, acute hypoxia and hypotension related to neurogenic stunned myocardium have the greatest effect on mortality and functional consequences after SAH. Potential therapeutic interventions for these complications, including the development of acute remission strategies to optimize cerebral perfusion in poor grade patients, maintaining normal temperature with systemic cooling systems, injections of erythropoietin to prevent severe anemia, maintaining normal blood sugar with continuous insulin infusion and suitable supportive hemodynamic therapy result in brain oxygenation [6]. Frontera JA et al. (2008) investigated cardiac arrhythmias after subarachnoid hemorrhage, risk factors and its effect on outcome. The results showed that significant clinical arrhythmias, which is often AF and abundant, occurred in 4% of the patients. Cardiac arrhythmias after SAH are associated with an increased risk of co-morbidities with other cardiovascular problems, prolongation of hospitalization and unpleasant outcome or death [7]. Sampson TR et al. (2010) examined the factors associated with the spread of anemia after SAH. The results indicated that prediction of anemia with the use of basic clinical variables is possible. Anemia is highly associated with surgery, which is largely justifiable due to loss of blood and high systematic inflammatory response (through cytokines that inhibit RBC production)[8]. Matthew MJ et al. (2004) conducted a survey on the association of cerebral natriuretic peptide of serum with hypernatremia and delayed ischemic neurologic deficit after SAH. The results showed that an increase in serum BNP level, which is independently related to hypernatremia and a significant increase in delayed neurological disorder in the 24-hour after onset of the disease can predict GCS in patients for 2 weeks [9].

## **2. Materials and Methods**

During this study, the clinical records of patients with non traumatic SAH were collected from the medical records unit of the hospital and they were investigated. Demographic characteristics (age and sex) of patients, information and evidence related to all defined complications of SAH (including anemia, fever, hyperglycemia, hypertension, sodium disorder and cardiac arrhythmia) were extracted and entered into researcher-made software. After completing the study, the results were entered into SPSS statistical software version 21. This is a cross sectional-descriptive study. The statistical population of the study was a group of patients with SAH who were admitted in ICU and statistical sample volume was all patients with SAH who are admitted in the ICU, Imam Khomeini Hospital of Urumia within 2010-

2015. The sampling method of the entire census and the tool for collecting information is also a checklist. The variables studied in this study are presented in Table 1

Table1. Investigated variables in the present study

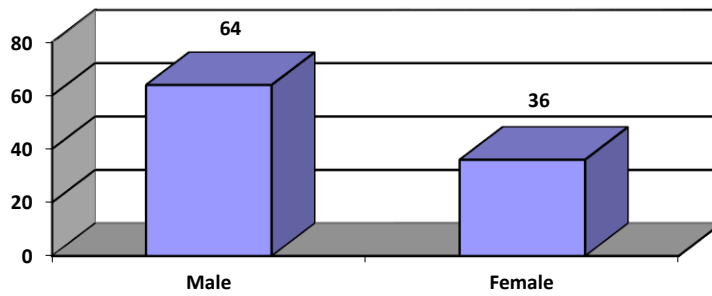
Row	Variable
1	Anemia ( Hb< 10 mg/dl )
2	Fever>37.5c auxiliary
3	Hyperglycemia> 200 mg /dl
4	Sodium disorders( sodium level out of 135- 145 )
5	Hypertension( systolic blood pressure >140 mmHg brachial )
6	Cardiac arrhythmia( all rhythm except normal sinus rhythm )

In this study, 500 clinical records of the patients with SAH who are admitted in the ICU (from 2010 -2017) were investigated. 10 patients due to equal GCS, 4 patients due to transfer to other medical centers and 3 individuals due to incomplete medical records were excluded from the study. The study was reviewed with 483 cases eventually.

### 3-Results

Of the 483 patients with SAH, 309 (64%) were male and 174 (36%) were female (Fig. 1). The average age was  $49.19 \pm 52.2$  years old (at least 3 and maximum 82 years old).

Figure 1. Distribution of sex relative frequency in patients with SAH



This study only include non traumatic SAH and brain ct angiography report was available for 438 patients (result was summarized in table 2 )based on aneurismal location size and GCS and general condition of patients microsurgical aneurismal clipping endovascular intervention and conservative treatment was recorded ( results summarized in table 3 ) The results reveal that out of 483 patients with SAH, 183 individuals (37.9%) had anemia and 300 patients (62.1%) had no anemia. fever was recorded in 174 (36 %) patient, 204 individuals (42.2%) had hypertension, hyperglycemia was detected in 111 (23%), sodium level also checked hypo and hypernatremic state only in 54 (11.2%) patient reported ,we also evaluated the cardiac rhythm only 131 (27.1%) patient cardiac arrhythmia( table 4 )

Table 2: frequency of brain ct angiography

Frequency	Positive for aneurysm	Negative for aneurysm
	346 (78.99 %)	92 (21%)

Table 3: frequency of intervention modality in patient with positive report of aneurysms in brain ct angiography

Microsurgery clipping	154(44.5 %)
Endovascular	85 (24.5%)
Conservative	107(30.09 %)

Table 4 : variable and frequency of them in patient

variable	number of patient consist the variable	number of patient without the variable	Total
Anemia	183	300	483

fever	174	309	483
Hypertension	204	279	483
Hyperglycemia	111	372	483
Sodium imbalance	54	429	483
Cardiac arrhythmia	131	352	483

Of 483 patients with SAH, 281 (58.2%) individuals survived and 202 (41.8%) individuals died. In the investigation on the outcome of patients with anemia, 108 patients (38.4%) out of 281 discharged patients were suffering from anemia and 173 individuals (61.6%) did not have anemia and 75 (37.1%) individuals out of 202 dead patients revealed the symptoms of anemia and 127 individuals (62.9%) did not. Chi-square statistical test presented that there is not a significant connection between the outcome of patients and anemia ( $P=0.42$ ).

Analysis of patient fever and outcome shows, out of 281 patients, 93 individuals (33.1%) had fever and 188 individuals (66.9%) had no fever, and out of 202 died patients, 81 (40.1%) had fever while 121 patients (59.9%) had no fever. Chi-Square test showed that there is no significant relationship between the outcome of patients and fever ( $P = 0.06$ ). also we calculate the p value equal 0.36 for relation between hypertension and SAH out com but statically analysis showed significant relationship between hyperglycemia arrhythmia and sodium disorder ( $p<0.05$ )( table 5)

Table 5. The relationship between the patients' outcome and SAH based on study variable

	Outcome	With	Without	Total	
Anemia	Discharge	108 (38.4%)	173 (61.6%)	281 (100%)	(P=0.42).
	Death	75 (37.1%)	127 (62.9%)	202 (100%)	
	Total	183 (37.9%)	300 (62.1%)	483 (100%)	
Fever	Discharge	93 (33.1%)	188 (66.9%)	281 (100%)	(P = 0.06).
	Death	81 (40.1%)	121 (59.9%)	202 (100%)	
	Total	174 (36%)	309 (64%)	483 (100%)	

Hypertension	Discharge	93 (33.1%)	188 (66.9%)	281 (100%)	P = 0.36
	Death	81 (40.1%)	121 (59.9%)	202 (100%)	
	Total	174 (36%)	309 (64%)	483 (100%)	
Sodium disorder	Discharge	24 (8.5%)	257 (91.5%)	281 (100%)	P = 0.001)
	Death	30 (14.9%)	172 (85.1%)	202 (100%)	
	Total	54 (11.2%)	429 (88.8%)	483 (100%)	
Hyperglycemia	Discharge	46 (16.4%)	235 (83.6%)	281 (100%)	P = 0.001
	Death	65 (32.2%)	137 (67.8%)	202 (100%)	
	Total	111 (23%)	372 (77%)	483 (100%)	
Cardiac arrhythmia	Discharge	24 (8.5%)	257 (91.5%)	281 (100%)	P = 0.001
	Death	30 (14.9%)	172 (85.1%)	202 (100%)	
	Total	54 (11.2%)	429 (88.8%)	483 (100%)	

#### Discussion:

the patients admitted to the ICU after SAH already have a high mortality rate, which can be incremented by preexisting co morbidities and the involvement of other organs and

Systems. Some authors [10-11] have demonstrated that variables, such as hypoxemia, electrolyte (hyper/hyponatremia)[12] and acid-base imbalances, hyperglycemia and hemodynamic instability could play an independent role as predictors of mortality in

SAH patients. For these reasons, after the surgical procedure of the ruptured aneurysm, these critical patients can develop several medical complications and should necessarily be placed at an ICU, with a trained staff in neurocritical care The results reveal that fever, anemia, and hyperglycemia have had the highest impact on mortality of the patients after SAH. Therefore, the findings are consistent with the study by Qureshi AI,. (13)The present study also recommends reviewing clinical trials for targeted interventions to prevent and treat commonly occurring complications after SAH. Findings of Frontera JA et al. correlate with the findings of this study about increased risk of death and cardiac arrhythmia has a significant relationship with mortality after SAH.(7) But in terms of the length of hospitalization in ICU, it is not comparable with the present study. Since the duration of admission in ICU has not been studied in this study. The results of studies by Sampson TR et al suggest anemia onset with the use of basic clinical variables is possible (8), and severe anemia as the result of surgery that is mostly caused by loss of blood and high systemic inflammatory response (through cytokines that inhibit production of RBC) is justifiable and is consistent with the view that anemia was one of the most common complications in the patients of the present study. The results of this study



indicate that the volume of lost blood after surgery at the time of admission of these patients in the ICU must be reviewed by specialists and nurses working in these special sectors.

On the other hand, although the GCS is critical in the neurological patients with acute brain disorders, including SAH, this scale measurement loses its accuracy when the patient is sedated, for example, the day after the surgical procedure. Several factors have been

Associated with poor outcome of patients with SAH (14-18) Rivero-Rodríguez et al (19) evaluated care-related demographic, clinical and imaging factors associated with poor prognosis in a retrospective cohort of 334 patients with SAH. The logistic

Regression analysis (odds ratio) showed an increased risk for some conditions, such as age >65 years old (OR=3.51), female sex (OR=2.51), systolic hypertension >60 mmHg (OR=4.82), hyperglycemia at admission (OR=3.93), rebleeding (OR=

16.5), vasospasm (OR=19.0), cerebral ischemia (OR=3.82), Fisher CT grade scale (OR=5.18), WFNS grade 4-5 (OR=2.09), the currently available predictive systems were conceived for analysis of the severity and approximate calculation of mortality

In a case mix of patients admitted to the ICU. Likewise, no prognostic index in use nowadays is able to predict mortality with 100% sensitivity and specificity in a group of patients. Moreover, these indexes are not accurate to predict individual mortality. For

Individuals, it is not recommended that intensive visits rely only on the index and its equation for calculation of death risk.

#### **4-Conclusion**

In this study, the frequency of patients' complications with SAH in the intensive care unit of Imam Khomeini Hospital of Urmia was evaluated in a 7-year period. The results show that the most common clinical complications after SAH are anemia, hyperglycemia, sodium disorder and cardiac arrhythmia, and the disorder in each of these post-SAH factors was affecting on the outcome of patients in the intensive care unit. The presence of anemia in patients after SAH can be associated with surgery that needs further investigation and studies. Cardiac arrhythmia, which is considered to be the most important complication after SAH, and other types of cardiac arrhythmias can be involved in unpleasant outcomes or death of patients. If we can control this variable in ICU outcome of patient can improve significantly

Ethical consideration:

All steps of this research were reviewed by Urmia University of Medical Sciences, ethical committee, ethical code NO ir.umsu.ac.ir.1395.420

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Conflict of interest

The authors declared no conflict of interest

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